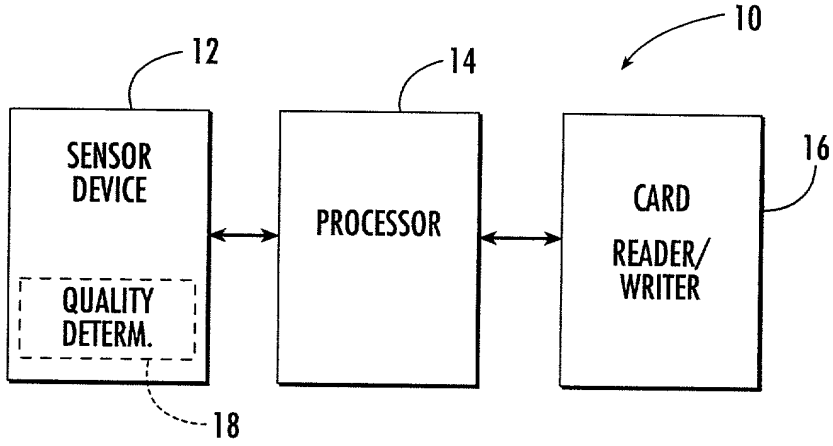

FIG. 1.

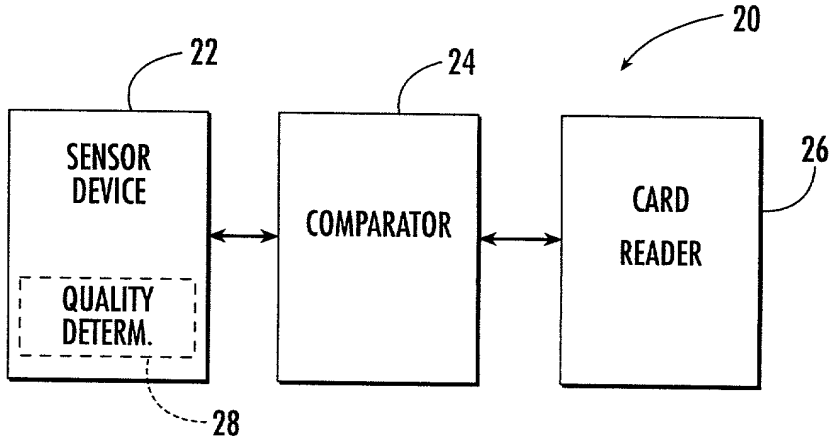

FIG. 2.

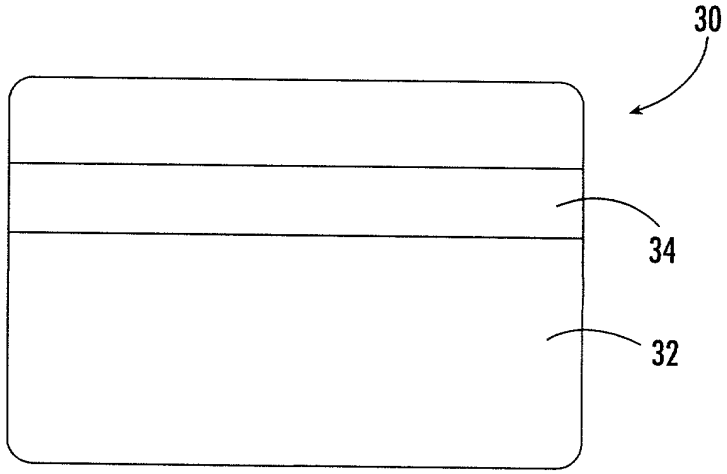

FIG. 3.

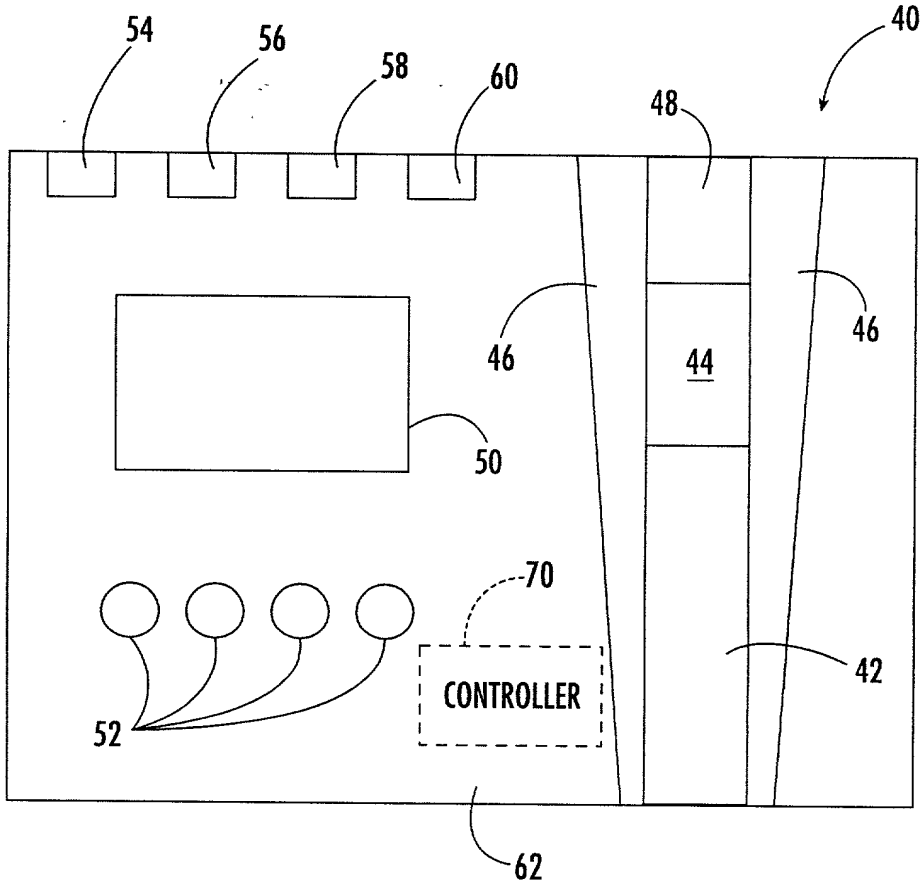

FIG. 4.

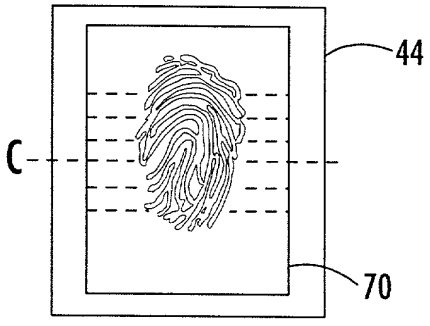

FIG. 5.

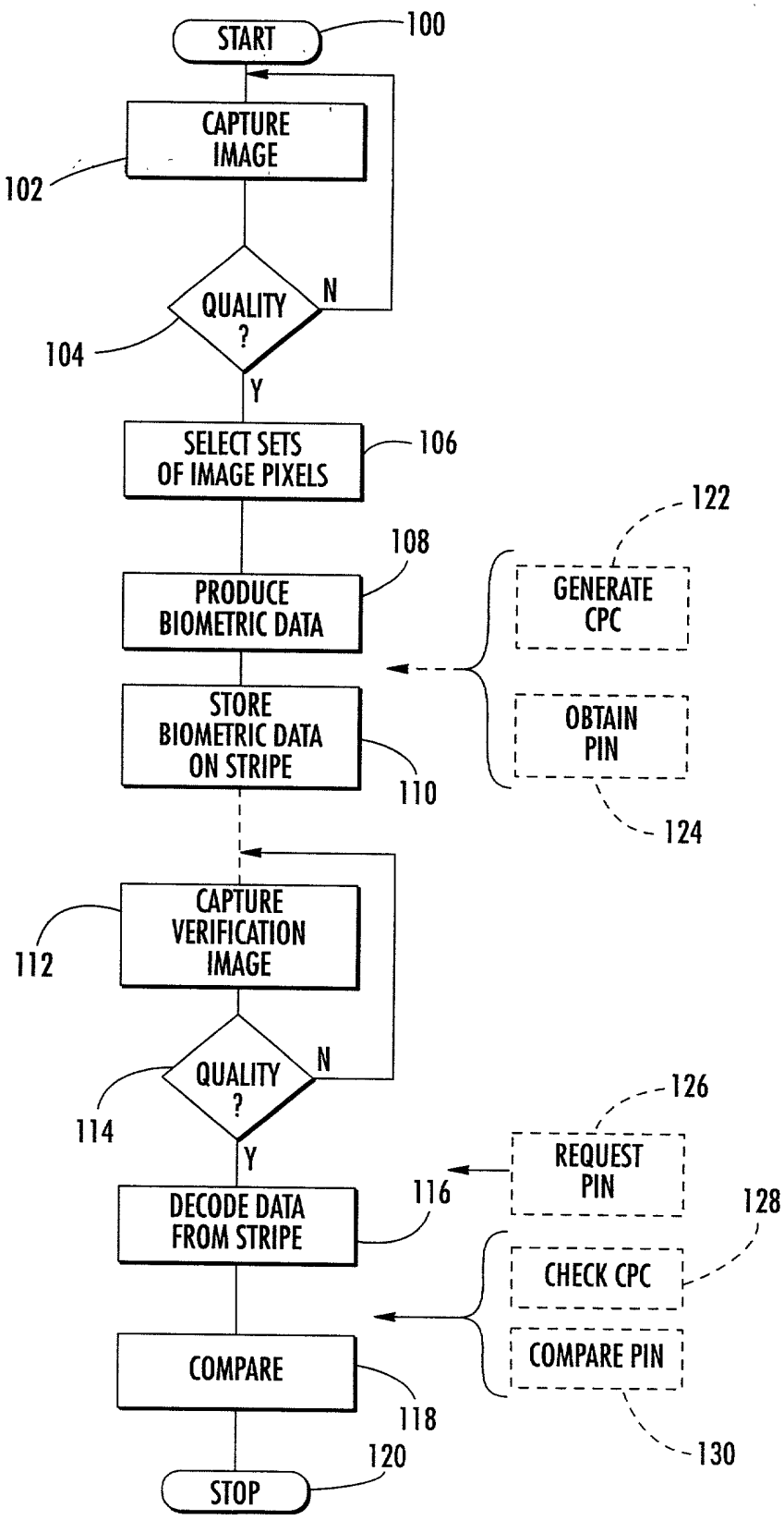

FIG. 6.

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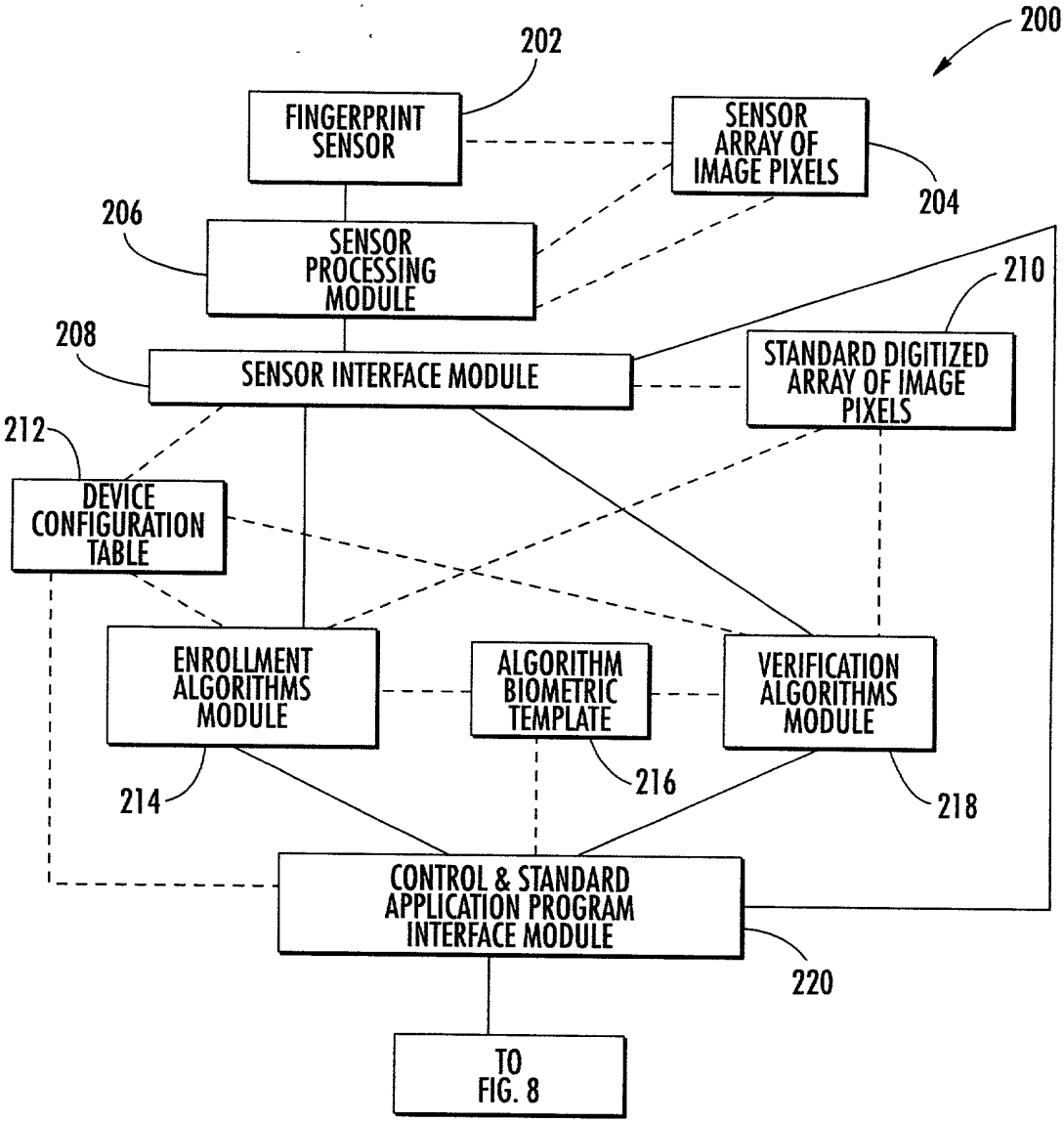
200
202
FINGERPRINT SENSOR
SENSOR ARRAY OF IMAGE PIXELS
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206
SENSOR PROCESSING MODULE
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208
SENSOR INTERFACE MODULE
STANDARD DIGITIZED ARRAY OF IMAGE PIXELS
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DEVICE CONFIGURATION TABLE
ENROLLMENT ALGORITHMS MODULE
ALGORITHM BIOMETRIC TEMPLATE
VERIFICATION ALGORITHMS MODULE
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CONTROL & STANDARD APPLICATION PROGRAM INTERFACE MODULE
220
TO FIG. 8

FIG. 7.

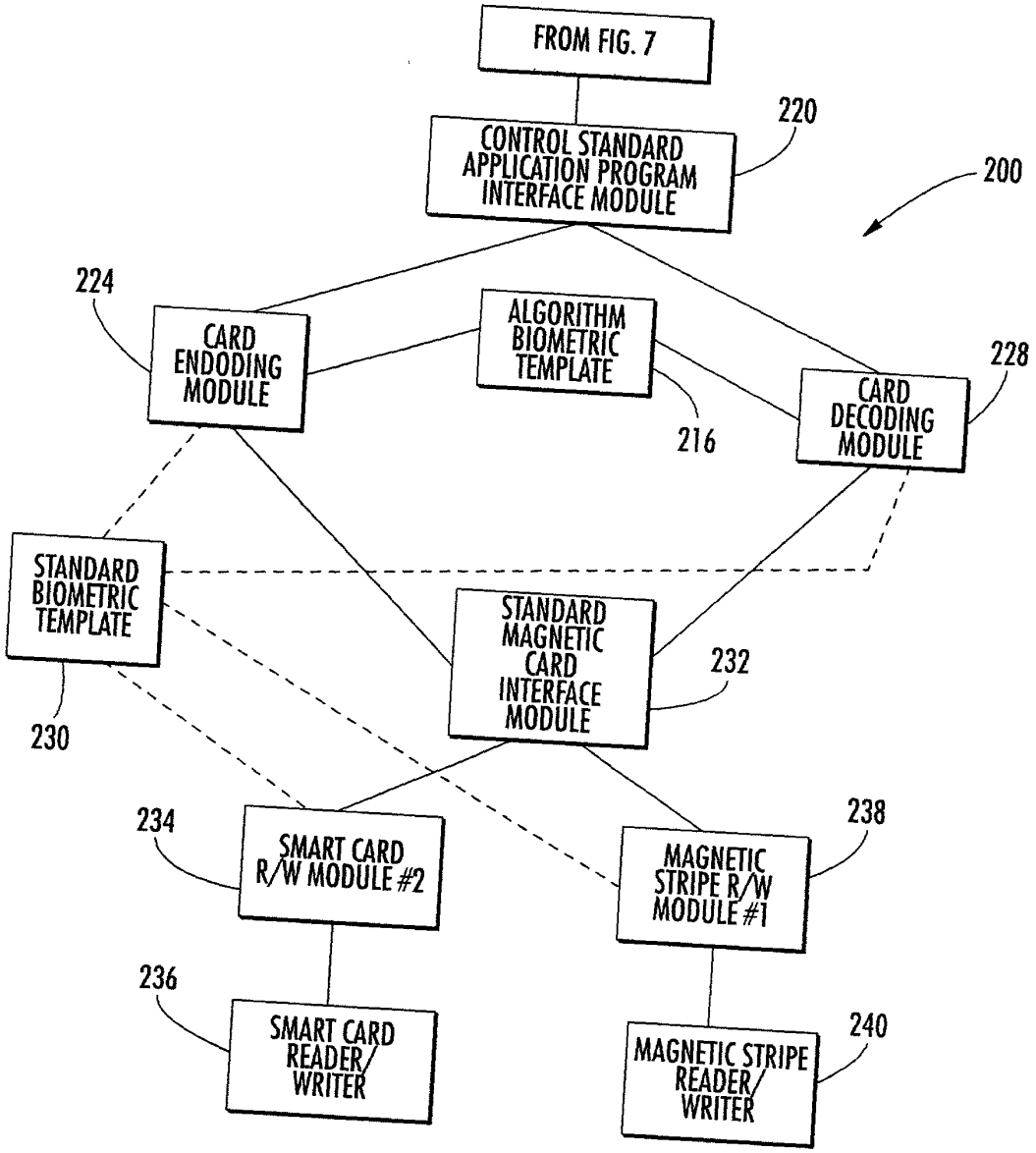
FROM FIG. 7
CONTROL STANDARD APPLICATION PROGRAM INTERFACE MODULE
220
200
224
CARD ENDODING MODULE
ALGORITHM BIOMETRIC TEMPLATE
216
CARD DECODING MODULE
228
STANDARD BIOMETRIC TEMPLATE
230
STANDARD MAGNETIC CARD INTERFACE MODULE
232
234
SMART CARD R/W MODULE #2
238
MAGNETIC STRIPE R/W MODULE #1
236
SMART CARD READER/ WRITER
240
MAGNETIC STRIPE READER/ WRITER

FIG. 8.

DEVICE CONFIGURATION TABLE

DESCRIPTION	MODULE NAME	VALUE (ESTABLISHED"AT COMPILE TIME")	COMMENTS
DEVICE CONTROL CODE		NINE NUMERIC CHARACTERS	USED FOR PREVENTING THEFT OF DEVICE ESTABLISHED AT COMPILE TIME
ENCODING APPROACH NUMBER		"00" TO "15"	SELECTED FROM THE ENCODING APPROACH TABLE. ESTABLISHED AT COMPILE TIME
SENSOR PROCESSING MODULE	SENRXX	WHERE "XX" EQUALS "00" TO "99"	ESTABLISHED AT COMPILE TIME
ENROLLMENT/VERIFICATION ALGORITHM MODULE#	ENRLXX AND VERFXX	WHERE "XX" EQUALS "00"	DEFAULT ALGORITHM SELECTED BASED UPON THE "ENCODING APPROACH NUMBER" (SEE ABOVE)
ENROLLMENT/VERIFICATION ALGORITHM MODULE#	ENRLXX AND VERFXX	WHERE "XX" EQUALS "01" (IF "BLANK" NO ALTERNATIVE ALGORITHM EXISTS)	SECOND ALGORITHM
ENROLLMENT/VERIFICATION ALGORITHM MODULE#	ENRLXX AND VERFXX	WHERE "XX" EQUALS "02" TO "14" (IF "BLANK" NO ALTERNATIVE ALGORITHM EXISTS)	
ENROLLMENT/VERIFICATION ALGORITHM MODULE#	ENRLXX AND VERFXX	WHERE "XX" EQUALS "15" (IF "BLANK" NO ALTERNATIVE ALGORITHM EXISTS)	LAST ALGORITHM
CARD ENCODING/DECODING MODULE# (DEFAULT = "0")	ENCDXX AND DECDXX	WHERE "XX" EQUALS "00" THAT IS THE ENCODING APPROACH NUMBER	DEFAULT MODULE SELECTED BASED UPON THE "ENCODING APPROACH NUMBER" (SEE ABOVE)
CARD ENCODING/DECODING MODULE#	ENCDXX AND DECDXX	WHERE "XX" EQUALS "01" TO "14" (IF "BLANK" NO ALTERNATIVE MODULE EXISTS)	
CARD ENCODING/DECODING MODULE#	ENCDXX AND DECDXX	WHERE "XX" EQUALS "15" (IF "BLANK" NO ALTERNATIVE MODULE EXISTS)	LAST MODULE
CARD READER/WRITER MODULE# (DEFAULT="0")	CDRDXX AND CDWRXX	WHERE "XX" EQUALS "00" TO "99"	ESTABLISHED AT COMPILE TIME
COERCIVITY		FOUR NUMERIC CHARACTERS (DEFAULT= HIGH COERCIVITY)	COERCIVITY LEVEL OF MAGNETIC STRIPE WRITER
SENSOR BAUD RATE		SIX NUMERIC CHARACTERS WHERE "9600"bps IS THE DEFAULT	ESTABLISHED AT COMPILE TIME

FIG. 9.

5,585,616

ENCODING APPROACH TABLE

ENCODING APPROACH NUMBER (COL 1)	ENCODING MAGNETIC STRIPE TRACK NUMBER (S) *** (COL 2)	MAXIUM SIZE OF "BIOMETRIC TEMPLATE" (BITS) (COL 3)	MAXIUM NUMBER OF CHARACTERS /TRACK (COL 4)	NO. OF BITS TRANSLATED AT A TIME (COL 5)	ENCODING TRANS-LATION TABLE (COL 6)	DATA FORMAT (COL 7)	TRACK FORMAT (COL 8)
0	1	474	79	6	0	ANSI/ISO ALPHANUMERIC	ISO
1	1	395	79	5	1	ANSI/ISO ALPHANUMERIC	ISO
2	3	428	107	4	2	ANSI/ISO NUMERIC	ISO
3	1	492	82	6	0	ANSI/ISO ALPHANUMERIC	AAMVA
4	3	492	82	6	0	ANSI/ISO ALPHANUMERIC	AAMVA
5	1	410	82	5	1	ANSI/ISO ALPHANUMERIC	AAMVA
6	3	410	82	5	1	ANSI/ISO ALPHANUMERIC	AAMVA
7	1	510	86	6	0	ANSI/ISO ALPHANUMERIC	AAMVA*
8	3	510	86	6	0	ANSI/ISO ALPHANUMERIC	AAMVA*
9	1	425	86	5	1	ANSI/ISO ALPHANUMERIC	AAMVA*
10	3	425	86	5	1	ANSI/ISO ALPHANUMERIC	AAMVA*
11	1	595	86	N/A	N/A	CUSTOM **	CUSTOM **
12	2	595	86	N/A	N/A	CUSTOM **	CUSTOM ** 210 bpi
13	3	595	86	N/A	N/A	CUSTOM **	CUSTOM **
14	2	510	86	6	0	ANSI/ISO ALPHANUMERIC	NON-STANDARD 210 bpi
15	2	428	107	4	2	ANSI/ISO NUMERIC	NON-STANDARD 210 bpi

FIG. 10.

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STANDARD BIOMETRIC TEMPLATE

230

FIELD	VALUE/SIZE	COMMENTS
HEADER: SOFTWARE VERSION NUMBER	"0" TO "256" - 8 BITS (8BITS/BYTE)	THE SOFTWARE VERSION NUMBER MAY RELATE TO THE ENROLLMENT/VERIFICATION ALGORITHM MODULE#, CARD ENCODING MODULE AND/OR ENCODING APPROACH NUMBER THAT ARE USED TO CREATE THE "BIOMETRIC" TEMPLATE.
COPY PROTECT CODE	6 BITS (8BITS/BYTE)	SEVEN BIT LRC CHARACTER MINUS THE PARITY BIT. THE COPY PROTECT CODE IS ENBEDDED IN THE "YARDSTICK" DATA.
"MINI-PIN"	"0" TO "999" - 10 BITS (8BITS/BYTE)	THE "MINI-PIN" IS EMBEDDED IN THE "YARDSTICK" DATA.
ENROLL FINGER CODE	3 BITS (8BITS/BYTE)	WHERE: 0 - MIDDLE, RIGHT, 1 - INDEX, RIGHT 2 - RING, RIGHT, 3 - MIDDLE, LEFT 4 - INDEX, LEFT, 5 - RING, LEFT 6 - OTHER FINGER
RESERVE	1 BITS (8BITS/BYTE)	
ALGORITHM BIOMETRIC TEMPLATE W/O HEADER		
DATA - "YARDSTICKS"	72 BYTES (7BITS/BYTE)	THE LAST BYTE IN EACH OF THE YARDSTICKS IS NOT USED
TRAILER	7 BITS (8BITS/BYTE)	- 4 BITS - EXTENDED PIN (0-9) - 3 BITS - ERROR BIT INCREMENT COUNTER ((0-7) SEE TABLE BELOW)
	7 BITS (8BITS/BYTE)	- 6 BITS USED FOR YARDSTICK LOCATIONS - 1 BIT HARD TO ENROLL FLAG
TOTAL	79 BYTES (7BITS/BYTE)	DOES NOT INCLUDE CONTROL CHARACTERS

FIG. 11.

ALGORITHM BIOMETRIC TEMPLATE

216

FIELD	VALUE/SIZE	COMMENTS
HEADER:	2 BYTE	HEX "01"
DATA - "YARDSTICKS"	60 BYTES	THE LAST BYTE IN EACH OF THE YARDSTICKS IS NOT USED
TRAILER	1 BYTE	- 4 BITS - EXTENDED PIN (0-9) - 3 BITS - ERROR BIT INCREMENT COUNTER ((0-7) SEE TABLE BELOW)
	1 BYTE	- 6 BITS USED FOR YARDSTICK LOCATIONS - 1 BIT HARD TO ENROLL FLAG
TOTAL	64 BYTES (8 BITS/BYTE)	

FIG. 12.

ERROR BIT RATE INCREMENT COUNTER TABLE

NUMBER OF BITS THAT FAILED DURING VERIFY FOR THE YARDSTICKS PROCESSED (BASE ERROR BIT RATE + ERROR BIT INCREMENT COUNTER)	ERROR BIT INCREMENT COUNTER	COMMENTS
20	0	TYPICAL ERROR BITS INCREMENT COUNTER IF NO PIN IS USED
21	1	
22	2	TYPICAL ERROR BITS INCREMENT COUNTER IF PIN IS USED
23	3	TYPICAL ERROR BITS INCREMENT COUNTER IF EXT PIN IS USED
24	4	
25	5	
26	6	
27	7	

FIG. 13.

5,963,680 - 05/05/99

210 STANDARD DIGITIZED ARRAY OF IMAGE PIXELS

FFFFFFFF			DDDDDDDD	BBBBBBBB
		GGGGGGGG		
EEEEEEEE			CCCCCCCC	AAAAAAAA

WHERE:

- "AAAAAAAA" ARE THE GRAY SCALE FOR COLUMN 0, ROW 0, THE BOTTOM RIGHT CORNER OF THE IMAGE
- "BBBBBBBB" ARE THE GRAY SCALE FOR COLUMN 0, ROW 255, THE TOP RIGHT CORNER OF THE IMAGE
- "CCCCCCCC" ARE THE GRAY SCALE FOR COLUMN 1, ROW 0
- "DDDDDDDD" ARE THE GRAY SCALE FOR COLUMN 1, ROW 255
- "EEEEEEEE" ARE THE GRAY SCALE FOR COLUMN 255, ROW 0, THE BOTTOM LEFT CORNER OF THE IMAGE
- "FFFFFFFF" ARE THE GRAY SCALE FOR COLUMN 255, ROW 255, THE TOP LEFT CORNER OF THE IMAGE
- "GGGGGGGG" ARE THE GRAY SCALE FOR COLUMN 128, ROW 128 WHICH SHOULD APPROXIMATE THE CENTER OF THE SENSOR FINGERPRINT IMAGE
- 8 BITS/ "CELL" WHERE "00000000" IS " NO RIDGE" ON A GRAY SCALE
- 8 BITS/ "CELL" WHERE "00000001" TO "11111111" IS "RIDGE" ON A GRAY SCALE DEPENDING UPON THE SENSOR NUMBER

FIG. 14.